Maine Department of Transportation

Highway Safety Improvement Program

Annual Report

for Period Ending

December 31, 1997

Reporting of: Hazard Elimination Projects
Rail-Highway Grade Crossing Projects
Crash Trends

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Executive Summary

The economic impact of road crashes in Maine is very significant. In 1996 alone, nearly 40,000 crashes involving approximately 110,000 people occurred on Maine's 22,500 miles of public roads. These motor vehicle collisions resulted in 166 fatalities, over 7,600 known injuries, and more than 9,100 possible injuries[1]. The estimated economic loss to Maine resulting solely from property damage and medical costs is over $1 billion per year[2], excluding lost time and productivity, and lost wages.

The Highway Safety Improvement Program (HSIP) funds capital improvements intended to reduce the number and severity of crashes that occur on Maine's public roads. The HSIP addresses two specific transportation safety areas:

- The Hazard Elimination Program addresses general road safety problems; and
- The Grade Crossing Improvement Program addresses railroad grade crossing safety problems at public roads.

Current funding for the HSIP in Maine is about $3.36 million per biennium for the Hazard Elimination Program (HEP) and $1.8 million per biennium for the Rail Grade Crossing Improvement Program (GCIP). At least one-half of the GCIP funds must be expended on grade crossing signal improvements.

The Safety Management Section located in the Bureau of Planning, Research & Community Services is responsible for the HSIP, though the activities associated with the HSIP are distributed throughout the Department.

Several HSIP accomplishments were achieved in 1997. Due to reorganization, the HSIP process was revised and documented. In addition to the capital improvement opportunities offered through the HSIP, operational, maintenance, enforcement and local safety countermeasures are now being considered. In addition, a project tracking data base has been developed to track projects from initial request through post construction performance evaluation. A PC-based relational data base has also been created to allow for ready access to 1994-1996 crash data.

Anticipated 1998 HSIP improvements include further refinements to the process, coordination of HSIP projects with other capital improvement projects, implementation of new relational data base projects (TIDE, CODES, CVISN), increased transportation safety project performance evaluations and improved communications within MDOT and with other transportation safety organizations and agencies.

This report has been prepared to review the effectiveness of the projects that have been undertaken through the HSIP in recent years. In addition, ten-year trend

[1] "Maine Highway Crash Facts 1996", Maine Department of Transportation.

[2] "Motor Vehicle Accident Costs", FHWA Technical advisory T-7570.2, 10/31/94.

analyses have been performed to determine the general status of transportation safety in Maine, and also to identify areas that may require an increase in focus. Specific findings of this report include the following highlights:

- In general, the period from 1987 through 1996 has seen a marked reduction in the fatal crash rate (down 38%) and the overall crash rate (down 22%). The recent improvement in the economy appears to be reversing this earlier trend however, as most crash rates are again on the increase.

- With a few exceptions, nearly all crash types have seen a roughly 30% reduction in crash rate over the past ten years. The exceptions, in descending order, are as follows:

    - Object in Road: +560%;
    - Animal: +99%;
    - Rear End: +9%; and
    - Run Off Road: -9%.

- While the most common type of crash classification in Maine is Rear End, it ranks a distant fifth in the number of resulting fatalities when compared to other crash types, as listed below in descending order. Note that some of the crash reports may sometimes incorrectly note the manner of crash -- for instance, some of the Head On crashes may actually have been an Intersection Movement crash:

    - Run Off Road (89,241 crashes, 650 fatalities);
    - Head On (23,568 crashes, 479 fatalities);
    - Pedestrian (3,751 crashes, 190 fatalities);
    - Intersection Movement (90,284 crashes, 149 fatalities); and
    - Rear End (116,605 crashes, 91 fatalities).

- Fatal crash rates have exhibited the largest relatively consistent decline on Major Collectors (down 32%).

- Work zone crashes have decreased from a high of 1,044 crashes in 1987 to 663 crashes in 1996, an overall decrease of 36%. The reductions by work zone type are listed below:

    - Utility: -47%;
    - Maintenance: -24%; and
    - construction: -38%.

- Hazard Elimination Program project locations for the 1987-1993 period have exhibited a 26% reduction in crashes and a crash cost reduction of 31% from the three years prior to construction to the three year post-construction period. The resulting benefit-to-cost ratio was 2.70 for these projects.

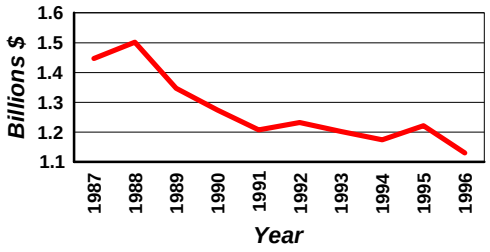
These findings indicate that the Hazard Elimination Program is effective in reducing the number and severity of crashes in Maine. Additional attention may need to be focused to address Run Off the Road, Head On, Pedestrian, and Intersection Movement crashes, as they tend to generate the greatest number of fatalities.

Additional analyses will be performed to ensure that the preliminary conclusions reached from these initial reviews are correct. Additional studies will also be made as relational data bases and access to them become available over the coming months. These studies will enable MDOT to better identify the types and extent of transportation safety problems in Maine, and they will help determine appropriate countermeasures to employ. Analyses will also be performed to better determine the effectiveness of each type of safety project utilized in recent years. The information obtained will be used to assess the potential benefits of future proposed safety improvement projects.

Introduction

All motor vehicle crashes are caused by vehicle, human or road elements, either singly or in any combination. Many motor vehicle crashes occur due to driver error. Road improvements cannot reduce crashes caused by driver error or vehicle deficiencies. However, in many cases, road improvements can reduce the likelihood of a crash from occurring, and may help reduce the severity of the crashes that do occur, regardless of their cause.

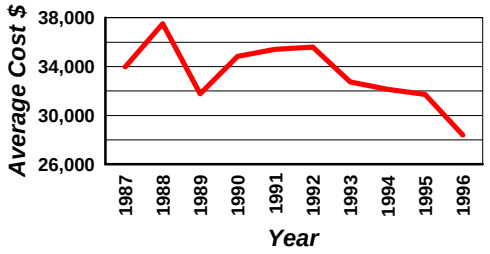
Economic Impact of Crashes in Maine



"State of Maine Accident & Highway Facts", MDOT, 1
"Maine Highway Crash Facts", MDOT, 1995 & 1996
"Motor Vehicle Accident Costs", FHWA Technical Ad

The economic impact of road crashes in Maine is very significant. In 1996 alone, nearly 40,000 crashes involving approximately 110,000 people occurred on Maine's 22,500 miles of public roads. These motor vehicle collisions resulted in 166 fatalities, over 7,600 known injuries, and more than 9,100 possible injuries[3]. The estimated economic loss to Maine resulting solely from property damage and medical costs is over $1 billion per year[4], excluding lost time and productivity, and lost wages. Note that the unit costs for property damage crash costs used in this report are $2,000 per crash are not in compliance with FHWA Technical Advisory T-7 ($2,000 per vehicle). This discepancy will be corrected in future reports. The cost differential for 1996 amounts to about $29 million, or 2.5% greater than the reported amount. This is because detailed data prior to 1992 cannot easily be retrieved.

Average Cost per Crash in Maine



"State of Maine Accident & Highway Facts", MDOT, 1
"Maine Highway Crash Facts", MDOT, 1995 & 1996
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From 1987 through 1996, both the cumulative cost of crashes and the average cost per crash have shown a decline in Maine (refer to adjacent figures). The cumulative annual economic impact to the state has dropped more than $300 million over the past ten years, or 22%. Over the same period the average cost per crash has declined nearly $5,500 or 16%. The reduction in the average cost per crash is indicative that the severity of injuries is also on the decrease.

While the downward trends are noteworthy, considerable improvements are necessary. For instance, the number of crashes continue to increase and the crash rate is again on the rise as the economy continues to improve. One way to help reduce the number and severity of highway crashes is by upgrading our roads to meet current safety standards through capital improvements.

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[3] "Maine Highway Crash Facts 1996", Maine Department of Transportation.

[4] "Motor Vehicle Accident Costs", FHWA Technical advisory T-7570.2, 10/31/94.

Purpose

Maine's highway safety capital improvement program is partially funded through the Highway Safety Improvement Program (HSIP) administered by the Federal Highway Administration. Its purpose is to reduce the number and severity of crashes, and to decrease the potential for crashes to occur on all public roads. The program is structured to encompass planning, implementation and evaluation of safety programs and projects. The HSIP consists of two distinct program areas:

1. **The Hazard Elimination Program** (HEP) addresses roadside hazards that exist on any public road.

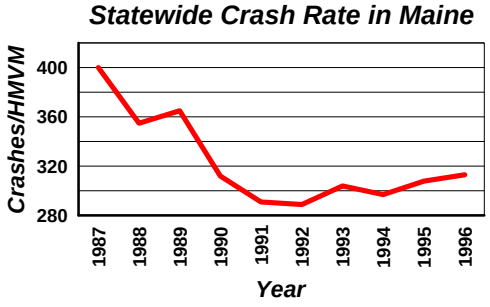
2. **The Grade Crossing Improvement Program** (GCIP) addresses safety issues for railroad grade crossings at public roads.

In Maine, responsibility for the development of the HSIP has recently been assigned to the Safety Management Section located in the Bureau of Planning, Research & Community Services. Several occurrences, including reorganization of the Department, have resulted in a renewed effort to define the HSIP process in Maine. The purpose of this annual report is to commence to evaluate the HSIP in a manner that will provide us with a better understanding of the effectiveness of the various safety initiatives undertaken in Maine.

Hazard Elimination Program

The Hazard Elimination Program portion of the Highway Safety Improvement Program implements safety projects with the basic objective of reducing the number and severity of crashes and to decrease the potential for crashes to occur on Maine's public roads. The HEP addresses safety problems, such as high crash rate locations and roadway safety deficiencies. The federal funding level for the 1998-1999 biennium will provide about $1,680,000 per year toward the HEP.

The crash rate in Maine has shown a general decrease over the past decade. From 1987 to 1992, the rate decreased approximately 27.5%. Since 1992, however, the crash rate has been slowly rising again, to its current level of about 315 crashes per one hundred million vehicle miles (HMVM). The recent rise in the crash rate is likely attributable to a strong economic growth over the same period. Due to the recent increase, the overall reduction in the crash rate over the past decade has been 22%.



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One method used to select potential HEP projects is to identify locations that exhibit crash rates that are statistically greater than would be expected. Generally, highway crashes are random events that occur at relatively low incidence levels. It is widely believed that crashes are distributed normally about the mean (state wide average) crash rate. The crash rate at a given location is therefor compared statistically to the statewide average. Maine uses the "Rate Quality Control Method" of statistical analysis. This is a statistical comparison of the actual crash rate for a given location to the expected rate, adjusted for urban/rural location, functional road class and exposure over time (annual average daily traffic). This comparison yields the Critical Rate Factor (CRF), which is an index of the relative crash rate of locations across the state. Sites that exhibit a CRF equal to or greater than one and that have experienced at least eight crashes in the most recent three year study period are termed High Accident Locations (HALs). All HALs are considered potential candidate projects. There were 1,324 HALs identified in the most recent three-year study period (1994-1996).

For the MDOT year 2000-2001 Biennial Transportation Improvement Program (BTIP), a subset of the HALs listing has been created to identify potential field review locations. This subset includes those locations that meet one or more of the following criteria:

- fatality involved;
- top 100 locations as based upon highest Critical Rate Factor;
- top 100 locations as based upon total cost of crashes; and
- top 100 locations as based upon total cost of injuries.

For the 2000-2001 BTIP, 228 HALs sites have met these criteria. Desktop analyses of these locations are being performed to determine if any crash patterns exist. Those locations that exhibit distinct patterns are being field reviewed to identify potential treatment alternatives, after which benefit-to-cost ratios are being calculated. Locations whose treatment alternatives exhibit the highest benefit-to-cost ratios (within the financial constraints of the HEP) will be recommended for inclusion in the BTIP.

In addition to identifying high hazard locations, potential projects are submitted by Metropolitan Planning Organizations, Regional Transportation Advisory Committees, municipalities, and the general public. Candidate projects that exhibit significant need, identifiable crash patterns, and that meet the overall transportation system strategies prescribed by the 20-year plan, are selected for further consideration. Also, statewide programs are included (such as guardrail improvements on the National Highway System to meet current standards).

The recent redefinition of the HSIP process within MDOT has significantly modified the approach taken during field reviews. In addition to attempting to identify appropriate capital improvements, significant effort is being placed on identifying, implementing and assessing the effectiveness of alternative treatments. These alternative treatments can be broadly categorized as operations, maintenance, enforcement, and other recommendations. The advantage of these alternative

treatments is that they generally provide low-cost and rapid responses to identified safety problems.

The effectiveness of the implemented capital improvement projects is measured by comparing the number and severity of crashes over the three-year period prior to construction with the crashes that occur over the three-year period after construction completion (commonly referred to as "before and after analyses"). Typically, the time period during construction is excluded due to the abnormal conditions that occur during construction.

Summary of HEP Projects Completed in 1995

Four hazard elimination program projects were completed by June 30, 1995. Of these, one was a statewide non-interstate striping project, two were intersection improvement projects, and the other was a traffic signal installation. The projects are summarized in Table 1.

Table 1
Summary of HEP Projects Completed in 1995

PIN	Location	Scope	Previous CRF[1]	1994 Crashes	1996 Crashes	Project Cost
5594.00	Rte. 90/131 Warren	Left Turn Lane	5.57	0	1	$392,531
5667.00	Rte. 11 Waterville	Traffic Signal	4.91	18[2]	5	$48,011
5671.00	Rte. 1 Nobleboro	Left Turn Lane	1.59	3	1	$205,159
6257.00	Non-Interstate state-wide	Striping	NA	NA	NA	$2,223,790
Totals				**21**	**7**	**$2,869,491**

[1] Critical Rate Factor for most recent 3-year period prior to project selection.
[2] 1993 Crash Data

Evaluation of Long-Term HEP Program Effectiveness

A review of the HEP projects that were completed between 1987 and 1993 has been done to assess the overall effectiveness of the HEP in Maine. The beginning date was selected because (1) using data that is more than 15 years old would provide limited benefit to today's needs, and (2) significantly more effort would be required to extract data prior to 1987. The latter date was selected to allow for a full three years of crash data following construction completion. Refer to Table 2, “Effectiveness Evaluation for HEP Projects 1987-1993”.

From 1987 to 1993, 34 HEP projects were constructed at a cost of $3.1 million. Project scopes included the installation of flashing beacons, installing traffic signals, bypass lane construction, channelization, and full intersection reconstruction with signal installation. Individual project costs ranged from $2,500 to $895,000. It is important to note that high-cost safety improvement projects, such as realignment projects, typically do not get funded under the HEP due to limited funds. Rather, these projects are included under the general reconstruction program. Non-HEP funded projects are not included in this analysis. Also, no analysis has been performed to compare safety improvement sites with unimproved control sites. Detailed reviews will be performed in the future. Review of the 1987-1993 study period indicates that total crashes in HEP project areas were reduced by more than 26%. The overall benefit-to-cost ratio for the program during the study period was 2.70, exclusive of maintenance and operation costs. The average cost was reduced from $19,190 to $17,957 per crash. This indicates that the injury severity similarly decreased where HEP projects were undertaken.

The HEP Projects done from 1987-1993 resulted in a 26% reduction in total crashes and a benefit-to-cost ratio of 2.70.

Effectiveness Evaluation for HEP Projects

1987-1993

										3 Year Period Before								3 Year Period After											
Town	*Location*	*PIN*	*Year of Completion*	*Cost*	*Service Life*	*Annualized Cost**	*Scope*	*Low Node*	*High Node*	*Total Crashes*	*K*	*A*	*B*	*C*	*PDO*	*Total*	*Cost Before*	*Total Crashes*	*K*	*A*	*B*	*C*	*PDO*	*Total*	*Cost After*	*3 Year Savings*	*Yearly Cost Savings*	*Final B/C Ratio*	*% Reduction Total Crashes*	*% Reduction Total Cost*
Arundel	Route 1, Old Limirick & River Rds	3433.00	1989	$140,000	20	$13,216	Construct Left Turn Lanes	7104	0000	11	0	0	4	3	4	11	$209,000	10	0	0	1	2	7	10	$88,000	$121,000	$40,333	3.05	9.09%	57.89%
Auburn	Manley Rd & Rodman Rd	3888.00	1989	$2,500	10	$356	Flashing Beacon	7574	0000	15	0	2	3	6	4	15	$590,000	14	0	1	1	6	6	14	$342,000	$248,000	$82,667	232.21	6.67%	42.03%
Augusta	Bridge St & State St	1982.00	1993	$90,000	10	$12,816	Signalize	7295	0000	27	0	1	5	5	16	27	$487,000	8	0	0	0	1	7	8	$33,000	$454,000	$151,333	11.81	70.37%	93.22%
Augusta	Community Drive & Civic Center Drive	1981.00	1993	$3,500	10	$498	Signalize	7302	0000	21	0	0	8	3	10	21	$365,000	13	0	0	0	4	9	13	$94,000	$271,000	$90,333	181.25	38.10%	74.25%
Bangor	Union St & Griffin Rd	0060.20	1990	$36,000	10	$5,126	Update Signals	5065	0000	39	0	1	8	8	22	39	$664,000	13	0	2	3	2	6	13	$518,000	$146,000	$48,667	9.49	66.67%	21.99%
Belgrade	Route 27 & 135	4959.00	1992	$2,500	10	$356	Flashing Beacon	7313	0000	6	0	0	0	0	6	6	$12,000	10	0	0	2	3	5	10	$139,000	($127,000)	($42,333)	-118.91	-66.67%	-1058.33%
Benton	Bridge St & Benton Ave	3451.00	1990	$20,000	10	$2,848	Signalize	6170	0000	22	0	0	3	3	16	22	$197,000	20	0	0	3	5	12	20	$227,000	($30,000)	($10,000)	-3.51	9.09%	-15.23%
Caribou	Route 1 & Fort St	4889.00	1993	$40,000	10	$5,696	Signalize	8979	0000	15	0	1	5	4	5	15	$446,000	12	0	0	2	4	6	12	$160,000	$286,000	$95,333	16.74	20.00%	64.13%
Caribou	Route 1 & Route 89	3446.00	1989	$156,000	10	$22,214	Signalize	8988	0000	21	0	1	2	4	14	21	$356,000	12	0	0	1	3	8	12	$109,000	$247,000	$82,333	3.71	42.86%	69.38%
Caribou	Route 1 & North Main St	1980.00	1988	$60,000	20	$5,664	Intersection Improvement w/o Signal	8998	0000	8	0	0	4	0	4	8	$152,000	2	0	0	0	0	2	2	$4,000	$148,000	$49,333	8.71	75.00%	97.37%
Chelsea	Route 17 & Route 226	3452.00	1990	$205,000	20	$19,352	Construct Bypass Lane	7266	0000	11	0	0	1	4	6	11	$124,000	5	0	0	1	2	2	5	$78,000	$46,000	$15,333	0.79	54.55%	37.10%
Columbia	Route 1 & Epping & Addison Rds	3448.00	1989	$120,000	10	$17,088	Channelization	7033	0000	11	0	1	3	1	6	11	$319,000	10	0	0	1	1	8	10	$71,000	$248,000	$82,667	4.84	9.09%	77.74%
Elliot	Route 236 & Beech Rd	3185.00	1989	$895,000	20	$84,488	Reconstruction	7179	0000	28	0	1	7	9	11	28	$625,000	6	0	0	2	0	4	6	$80,000	$545,000	$181,667	2.15	78.57%	87.20%
Elliot	Route 236 & Route 101	Group	1992	$2,500	10	$356	Signalize	7184	0000	12	0	0	1	2	9	12	$92,000	16	0	0	2	4	10	16	$168,000	($76,000)	($25,333)	-71.16	-33.33%	-82.61%
Falmouth	Buchnam, Falmouth, & Middle Rds	3436.00	1990	$462,000	10	$65,789	Signalize	4046	0000	22	0	0	1	1	20	22	$95,000	7	0	0	0	1	6	7	$31,000	$64,000	$21,333	0.32	68.18%	67.37%
Falmouth	Leighton & Auburn Rds	3888.00	1988	$2,500	10	$356	Flashing Beacons	7494	0000	11	0	0	2	2	7	11	$124,000	5	0	0	0	0	5	5	$10,000	$114,000	$38,000	106.74	54.55%	91.94%
Hampden	Route 202 & Coldbrook Rd	4779.00	1992	$34,000	10	$4,842	Signalization	7015	0000	23	0	3	2	3	15	23	$699,000	8	0	1	0	1	6	8	$211,000	$488,000	$162,667	33.60	65.22%	69.81%
Lewiston	College & Pettengill Sts	3888.00	1989	$2,500	10	$356	Flashing Beacon	7792	0000	6	0	0	1	2	3	6	$80,000	8	0	0	0	1	7	8	$33,000	$47,000	$15,667	44.01	-33.33%	58.75%
Millinocket	Central & Sycamore Sts	3449.00	1990	$30,000	10	$4,272	Update Signal	6380	0000	17	0	4	0	1	12	17	$763,000	13	0	0	2	2	9	13	$128,000	$635,000	$211,667	49.55	23.53%	83.22%
Orono	Forest & Stillwater Ave	3888.00	1989	$2,500	10	$356	Flashing Beacon	1930	0000	4	0	0	1	1	2	4	$59,000	17	0	0	1	3	13	17	$119,000	($60,000)	($20,000)	-56.18	-325.00%	-101.69%
Oxford	Route 26 & Skeetfield Rd	3888.00	1988	$2,500	10	$356	Flashing Beacon	7060	0000	12	0	0	0	4	8	12	$92,000	13	0	0	0	5	8	13	$111,000	($19,000)	($6,333)	-17.79	-8.33%	-20.65%
Poland	Route 11 & 26	3888.00	1989	$2,500	10	$356	Flashing Beacon	7274	0000	13	0	0	0	1	12	13	$43,000	18	0	1	0	7	10	18	$333,000	($290,000)	($96,667)	-271.54	-38.46%	-674.42%
Portland	Deering Ave & Williams St	3888.00	1989	$2,500	10	$356	Flashing Beacon	3098	0000	24	0	2	2	7	13	24	$591,000	9	0	0	2	0	7	9	$86,000	$505,000	$168,333	472.85	62.50%	85.45%
Presque Isle	State & Second Sts	3888.00	1988	$2,500	10	$356	Flashing Beacon	4349	0000	11	0	0	0	0	11	11	$22,000	7	0	0	0	1	6	7	$31,000	($9,000)	($3,000)	-8.43	36.36%	-40.91%
Rockland	Broadway & Rankin St	4987.00	1993	$42,000	10	$5,981	Signalize	5163	0000	13	0	0	2	5	6	13	$179,000	7	0	1	3	0	3	7	$294,000	($115,000)	($38,333)	-6.41	46.15%	-64.25%
Rockport	Route 17 & Rte 90	Unknown	1988	*$40,000*	10	$5,696	Signalize	7147	0000	25	0	1	1	8	15	25	$398,000	21	1	0	1	4	15	21	$2,742,000	($2,344,000)	($781,333)	-137.17	16.00%	-588.94%
Scarborough	Spring & Mussey Rds	3888.00	1989	$2,500	10	$356	Flashing Beacon	6827	0000	19	0	1	2	3	13	19	$335,000	35	0	0	2	6	27	35	$240,000	$95,000	$31,667	88.95	-84.21%	28.36%
Standish	Route 25 & Saco & Manchester Rds	5144.00	1993	$5,000	10	$712	Flashing Beacon Signs Striping	7552	0000	14	0	2	1	3	8	14	$469,000	13	0	0	1	6	6	13	$162,000	$307,000	$102,333	143.73	7.14%	65.46%
Waterboro	Route 4/202 & West Rd	Unknown	1991	*$40,000*	10	$5,696	Signalize	6294	0000	18	0	1	4	1	12	18	$367,000	12	0	0	2	2	8	12	$126,000	$241,000	$80,333	14.10	33.33%	65.67%
Waterville	KMD & I-95	4978.00	1993	$566,000	10	$80,598	Signalization	9058	0000	28	0	0	2	6	20	28	$226,000	28	0	0	3	5	20	28	$243,000	($17,000)	($5,667)	-0.07	-0.00%	-7.52%
Windham	Route 202 & River Rd	5148.00	1993	$34,000	10	$4,842	Signalize	6141	0000	26	0	1	2	6	17	26	$400,000	28	0	0	3	5	20	28	$243,000	$157,000	$52,333	10.81	-7.69%	39.25%
Windham	River Rd & Windham Ctr Rd	3888.00	1989	$2,500	10	$356	Flashing Beacon	6382	0000	14	0	3	5	3	3	14	$783,000	12	0	0	3	1	8	12	$143,000	$640,000	$213,333	599.25	14.29%	81.74%
Windham	Route 302 & White Bridge Rd	3256.00	1990	$24,000	10	$3,418	Signalize	7340	0000	18	0	2	0	7	9	18	$511,000	14	0	0	2	4	8	14	$164,000	$347,000	$115,667	33.84	22.22%	67.91%
York	Route 1 & Old Post Rd	3888.00	1989	$2,500	10	$356	Flashing Beacon	7043	0000	30	0	1	6	6	17	30	$544,000	12	0	1	1	4	6	12	$304,000	$240,000	$80,000	224.72	60.00%	44.12%
TOTALS				**$3,075,000**	**10**	**$437,880**	(Excluding Maintenance & Operations)			**595**	**0**	**29**	**88**	**122**	**356**		**$11,418,000**	**438**	**1**	**7**	**45**	**95**	**290**	**438**	**$7,865,000**	**$3,553,000**	**$1,184,333**	**2.70**	**26.39%**	**31.12%**

*Based on 6% interest over the service life of the project.

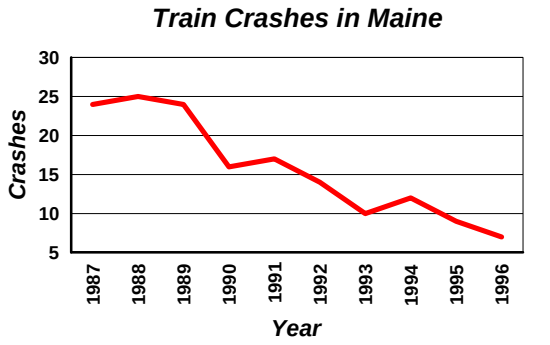
Average Cost Per Crash Before = **$19,190**

Average Cost Per Crash After = **$17,957**

Grade Crossing Improvement Program

The Grade Crossing Improvement Program (GCIP) portion of the Highway Safety Improvement Program implements safety projects at railroad grade crossings with public roads. The current federal level of funding for the GCIP is $1,800,000 per biennium (same level as 1991, per ISTEA requirement). At least one-half of this money must be spent on crossing signal improvements.

There are 1,218 grade crossings in Maine, of which 676 are active grade crossings located at public roads. There are 191 grade crossings at public roads utilizing only cross bucks as protection devices.



"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

The number of grade crossing crashes in Maine has been on a steady decline from 1987 through 1996 (see adjacent figure). The number of grade crossing crashes per year has decreased from a decade high of 25 in 1988 to only 8 in 1996, which represents a 71% drop in grade crossing crashes. Because there are few crashes in Maine involving trains, however, the analysis is highly volatile. For example, the addition of only one crash in 1996 would represent a 12% increase in that year's total.

Project selection for the GCIP consists of periodic field reviews of all active grade crossings to determine their condition, coupled with an estimate of the crash potential as determined from a US DOT crash potential equation. Four criteria are used in evaluating each grade crossing: surface condition; sight distance; site characteristics; and crash potential. Values are assigned to the pertinent criteria (i.e., sight distance is not a critical element at a crossing that currently utilizes an active protection device), and the criteria are weighted dependent upon the type of project that would be constructed, as defined below:

Table 3
GCIP Prioritization Criteria

	Weight	Rehab Crossing	Install ACWD	Rehab ACWD	Total Rehab	Improve Sight	Recon Approach
Surface	23%	42.8%	NA	NA	42.8%	NA	NA
Sight	23%	NA	30.1%	NA	NA	30.1%	30.1%
Site	23%	NA	30.1%	NA	NA	30.1%	30.1%
Crash	31%	57.2%	39.8%	100%	57.2%	39.8%	39.8%

The grade crossing locations are prioritized as based upon the combined weights of the four criteria, and the highest priority crossings are submitted for project funding consideration.

Ten rail-highway grade crossing improvement projects were completed in 1995 at a total cost of $872,015. There were six projects involving crossing rehabilitation without a signal, two involving crossing rehabilitation with a signal, one signal rehabilitation project, and one new signal project. There have been no crashes with trains since construction completion at the two locations that experienced crashes prior to construction, but there was one crash at a location that had none prior to construction. The projects are summarized in the table below.

Table 4
Summary of GCIP Projects Completed in 1995

PIN	Location	Scope	Crash Potential (1)	1993 Crashes	1996 Crashes	Project Cost
5239.00	Waldoboro	Install Signal	0.054	1(2)	0	$51,537
5677.00	Rte. 11 Ashland	Rehab Signal	0.070	0(3)	0	$29,959
5685.00	Rte. 11 Indian Purchase	Rehab w/o Signal	0.018	0	0	$69,055
5906.00	Bridge Street Madawaska	Rehab w/Signal	0.140	0	0	$77,141
5907.00	River Road Oakfield	Rehab w/Signal	0.062	1	0	$90,173
5908.00	Rte. 1 Presque Isle	Rehab w/o Signal	0.270	0	1	$149,850
5909.00	Allen Street Presque Isle	Rehab w/Signal	0.080	1	0	$103,786
5910.00	North Street Presque Isle	Rehab w/Signal	0.100	0	0	$112,715
5912.00	Rte. 1A Brewer	Rehab w/Signal	0.105	0	0	$97,714
5915.00	Rte. 15 Orrington	Rehab w/Signal	0.070	0	0	$90,085
Totals				**3**	**1**	**$872,015**

(1) Crash Potential calculated from an equation by the Federal Railroad Administration
(2) 1991 Crash Data
(3) 1994 Crash Data

1997 HSIP Accomplishments

Several HSIP accomplishments were achieved in 1997 for the State of Maine. A major focus has been the redefinition and implementation of the revised HSIP. This has included the achievement of many key accomplishments, including:

- developing draft documentation of the HSIP process and receiving comments;
- identifying and resolving HSIP process and policy issues;
- development of electronic database field review forms for both the HEP and GCIP programs;
- initiating the process to obtain two laptop computers to allow direct field data entry;
- identifying non-capital approaches such as maintenance, operations, enforcement, and municipal opportunities to improve safety;
- development of a project tracking data base that will follow a project from initial request to post construction evaluation;
- development of a PC-based crash data base for the 1994-1996 study period;
- completion of 87 field reviews (to date) and recommendations for the HEP program;
- completion of 69 field reviews (to date) and recommendations for the GCIP program;
- the creation of vital communication links with local municipalities and MDOT functional groups.

SMS has also been involved in the development and enhancement of linkages to disparate databases for improved data accessibility and accuracy, including:

1. ***T***ransportation ***I***nformation for ***D***ecision ***E***nhancement (TIDE)

   TIDE is a GIS-linked data warehouse. Phase I will contain road characteristics, crash data, and railroad grade crossing data from current flat file databases (e.g., TINIS and Pavement Management System data bases). Phase I is scheduled to be completed in 1998. TIDE will allow users to access and query current and historical data on demand without the need for specialized computer programming skills. TIDE will also allow users to query directly from the database or from a map, and will similarly allow reporting either in a tabular format or on a map. It is anticipated this project will allow much greater user access to the data, and it will likely result in data quality improvements over time as the demand for it grows.

2. ***C***ommercial ***V***ehicle ***I***nformation ***S***ystems and ***N***etworks (CVISN)

   CVISN is the commercial vehicle subset of Intelligent Transportation Systems (ITS). Its intent is to utilize technology to enhance commercial vehicle safety and operations. CVISN is being developed by state representatives from the FHWA Office of Motor Carriers, MDOT, the Bureau of Motor Vehicles, the Bureau of Taxation, Maine State Police, the Courts System, and the motor carrier industry. CVISN will allow government agencies, the motor carrier industry, and other parties engaged in commercial vehicle safety and regulation to exchange information electronically. The CVISN project has recently completed a Draft Business Plan that outlines short-term and long-term goals, objectives, strategies and specific projects. The work currently being done involves the assignment of a USDOT number to all intrastate carriers registering vehicles in excess of 26,000 pounds, and in data identification and mapping as a preliminary step to linking the various data bases that are utilized in Maine.

3. ***C***rash ***O***utcome ***D***ata ***E***valuation ***S***ystem (CODES)

   CODES is a probabilistic program that will enable the linkage of crash and road characteristics files with injury and medical cost data while maintaining patient confidentiality. The data sources range from Police Accident Reports, EMS files, and hospital files. This linked data will provide a greater ability to evaluate the severity of injuries by crash type and by crash location, and will provide more complete and accurate costs resulting from crashes. The CODES project is expected to be operational by January 1999.

These tools will greatly enhance the ability of the SMS group to provide accurate and reliable data in a timely manner to decision makers and interested parties. This increase in data accessibility will enhance the HSIP project selection process and will help SMS assess the performance of HSIP projects.

1998 Anticipated HSIP Improvements

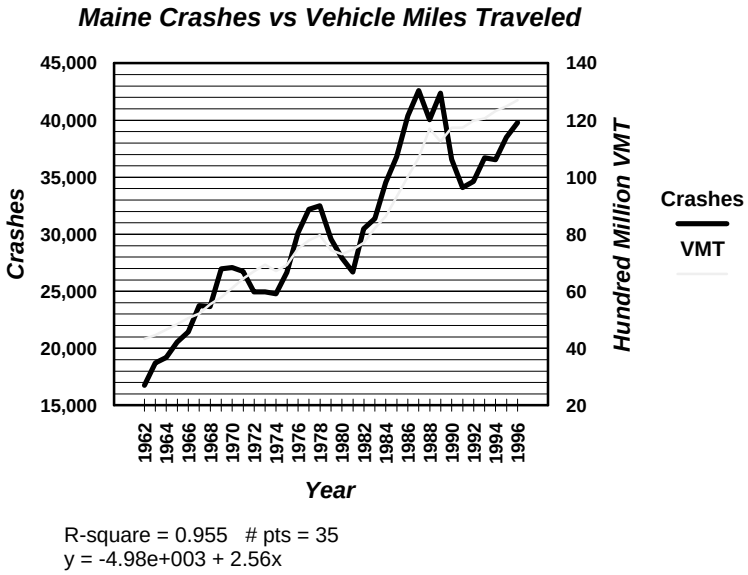
The management of the HSIP in particular, and transportation safety in general will continue to be improved upon in 1998. Specifically, Maine's HSIP process will be further enhanced by:

- further refinements in the HSIP process (primarily related to the selection of potential projects, field reviews, and analysis);
- coordination of safety improvement needs with other capital programs;
- increased emphasis to enhancing highway safety through utilization of operation, maintenance, enforcement, and other initiatives resulting from safety reviews;

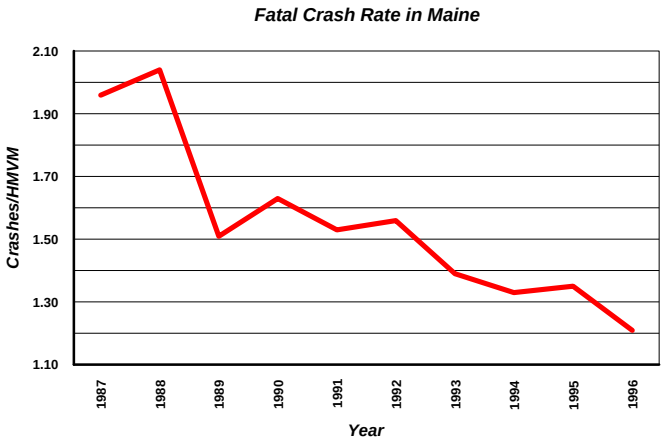
- implementation of current database projects including TIDE, CVISN and CODES;
- continued development of linkages to currently disparate data bases*;*
- increased data base analyses;
- increased transportation safety performance evaluations;
- increased communications both within MDOT and with other transportation safety advocates.

Selected Crash Data Trends

Crash data in Maine is currently collected at the scene of the crash by the investigating law enforcement officer if the damage caused by the crash is greater than $500, or if an injury or a fatality occurs. This data collection is accomplished through utilization of the Police Accident Report (PAR). All PARs are submitted to the Maine State Police for review, and then forwarded to MDOT for central data entry.

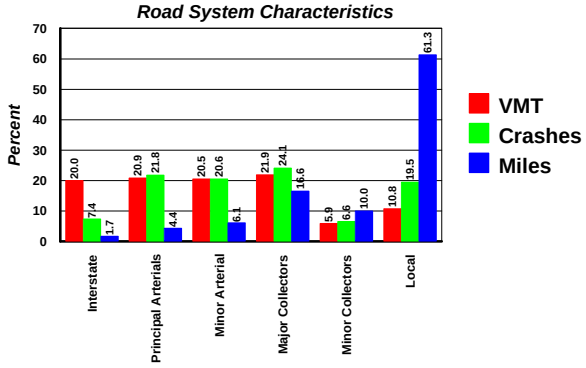


The number of crashes in Maine has increased over time with the increase in vehicle miles of travel. Since 1991 the number of crashes has been growing at a rate faster than the rate of growth for vehicle miles traveled. This recent trend is not atypical from normal patterns as illustrated in the adjacent figure. The number of crashes is much more volatile than the number of miles of travel. The number of vehicle miles of travel has shown steady growth since 1962 with only small peaks and valleys, whereas the number of crashes has fluctuated widely.



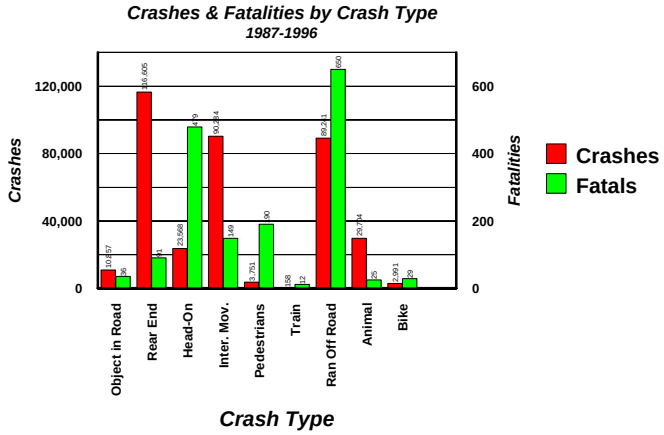
"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

The fatal crash rate in Maine has shown a decline over the past ten years. The fatal crash rate has dropped from nearly two fatal crashes per hundred million vehicle miles traveled to slightly over 1.2, a 38% drop. This drop may be largely attributable to improvements in automobile safety and the utilization of safety belts and air bags, as well as road improvements.



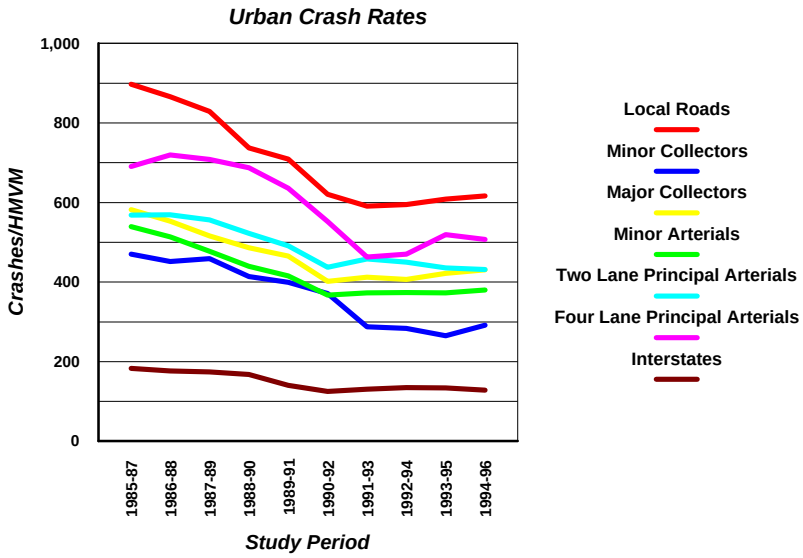
Based on Police Accident Reports for 1994-1996
Systems Inventory Section, MDOT, 1997

Over 85% of Maine's crashes are distributed evenly over Principal and Minor Arterials, Major Collectors, and Local Roads. It is interesting to note that local roads make up 61% of the 22,500 miles of roadway in the state, 10% of the vehicle miles traveled, and 20% of the crashes. In contrast, Interstates comprise 1.7% of the total miles, 20% of the vehicle miles traveled, and 7.4% of the crashes.



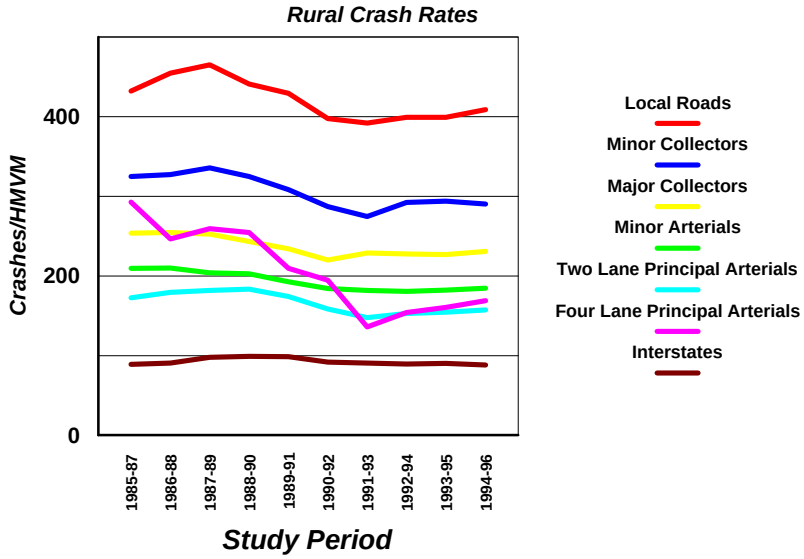
"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

Rear End crashes are the most common type of crash. More than 116,000 Rear End crashes have occurred from 1987 through 1996 (32% of all crashes). However, rear end crashes are the least severe based on the ratio of fatal crashes to total crashes. Run Off the Road crashes, on the other hand, account for the most fatal crashes and the third highest total number of crashes. Train crashes are the most severe, but few crashes involving trains occur in Maine.

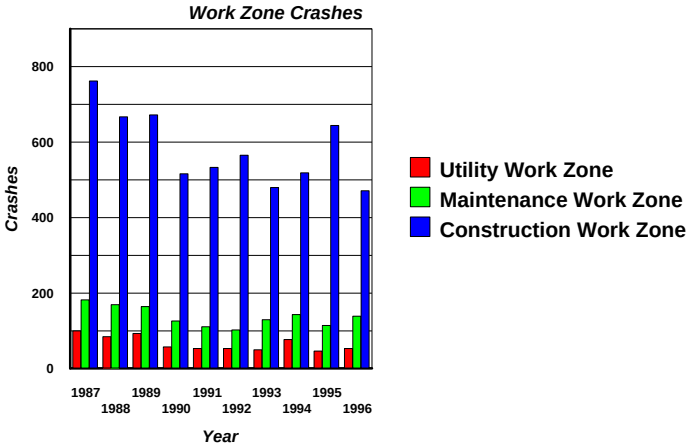


"Accident Rate Tables", MDOT, 1987-1996

The crash rates in urban settings are nearly twice as great as those for rural areas. The crash rate is generally indicative of road classification -- the higher the road class the lower the crash rate. There is an exception in that four lane principal arterials exhibit higher than expected crash rates, and minor collectors show lower crash rates than expected. The exception for Rural Crash Rates is also with four lane principal arterials, yet the disparity is less evident. Note that road classification mileage changes have occurred, especially between Principal Arterials and Minor Arterials, and Major Collectors and Minor Collectors, particularly in 1992 and 1993.



*"Accident Rate Tables", MDOT, 1987-1996



"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

Work zone crashes have shown a downward trend from 1987 through 1996, except for a recent peak during the 1995 construction season. The majority of all work zone crashes occur in construction zones, as indicated in the adjacent graph. As a result, MDOT has conducted training programs with its own personnel and also with local communities.

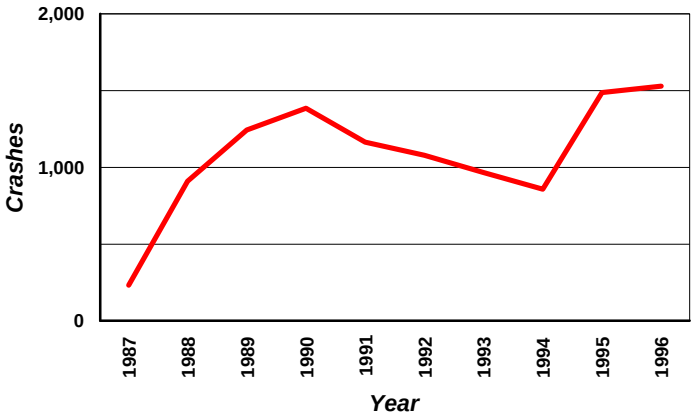
Trends for Specific Crash Types

From 1987 through 1996, Object in Road and Animal crashes have increased dramatically (+560% and +99%, respectively). Rear End crashes increased somewhat (+9%), while Run Off the Road crashes decreased marginally (-5%). All other crash types decreased about 30% over the past ten years, as summarized in the following table.

Crash Type	Number of Crashes in 1996	Ten-Year Change
Object in Road	1,530	560%
Animal	4,148	99%
Rear End	12,655	9%
Run Off Road	9,088	-5%
Bicycle	285	-30%
Head On	2,220	-32%
Intersection Movement	8,368	-34%
Pedestrian	337	-35%
Commercial Vehicle	2,253	-42%

The following charts show ten-year trends for specific crash types. The following information is indicated for each graph: Net Change (1987-1996), Ten Year High, Ten Year Low, Ten Year Average, and Ten Year Rate of Change. During the ten-year period, total crashes dropped 6.6%, with a high of 42,598 crashes and a low of 34,093 crashes. The ten-year average was 38,187 crashes per year.

Object in the Road

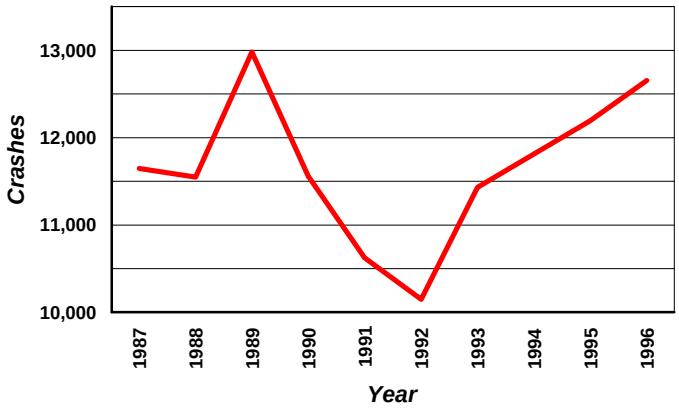


"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

Net Change ('87-'96)= +1,298 or +559%
High= 1,530
Low= 232
Average= 1,086
Rate of Change= +76 crashes per year

The dramatic increase (+560%) in Object in Road crashes is likely due to an increase in animal crashes. Refer to "Animal Crashes" chart.

Rear End Crashes

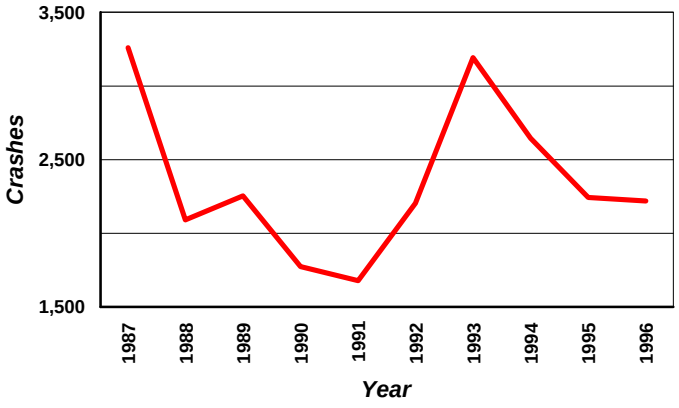


"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

Net Change ('87-'96)= +1,007 or +8.6%
High= 12,980
Low= 10,148
Average= 11,661
Rate of Change= +42 crashes per year

Rear End crashes decreased approximately 22% during 1989-1992, but have increased 25% since, resulting in an overall increase of 9% for the past ten years.

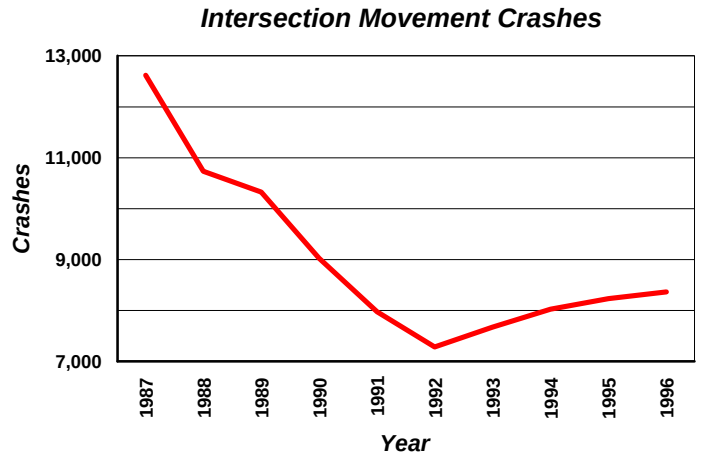
Head-On Crashes



"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

Net Change ('87-'96)= -1,040 or -32%
High= 3,260
Low= 1,680
Average= 2,356
Rate of Change= -9.5 crashes per year

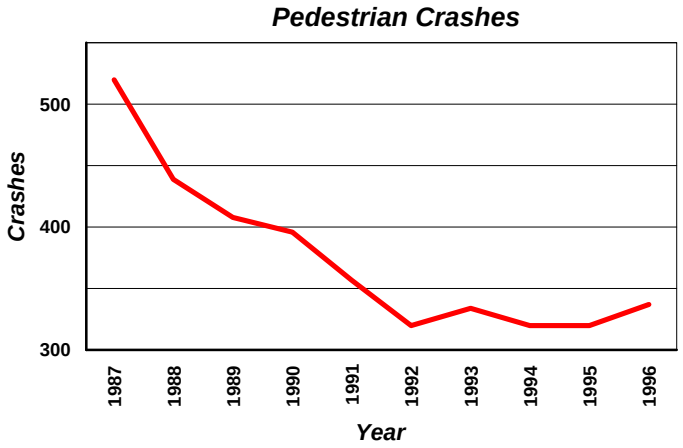
Head-On crashes appear to be highly volatile and cyclic, but at present there appears to have been a 32% reduction over the past ten years. Intersection crashes may be included due to possible coding errors on police crash reports.



"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

Net Change ('87-'96)= -4,255 or -31%
High= 12,623
Low= 7,289
Average= 9,028
Rate of Change=
-437 crashes per year

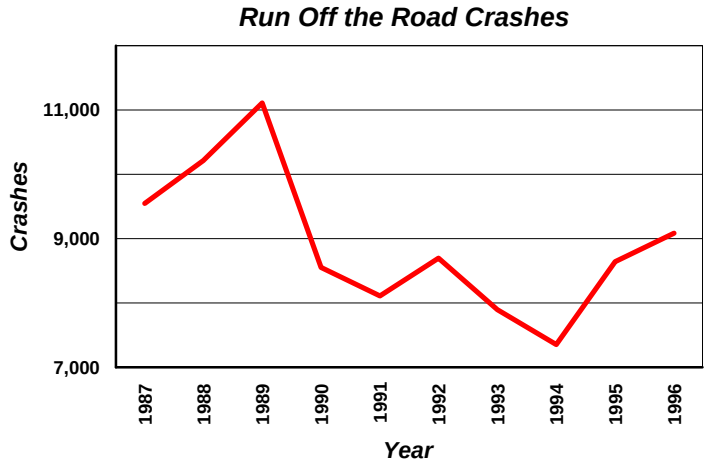
Intersection Movement crashes decreased significantly during the economic downturn, but have increased at a moderate rate since 1992. The overall ten year reduction amounts to 34%.



"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

Net Change ('87-'96)= -183 or -35%
High= 520
Low= 320
Average= 375
Rate of Change=
-19 crashes per year

Pedestrian crashes dropped significantly during the economic downturn, and have remained at the lower level. The total reduction over the ten year period has been 35%.

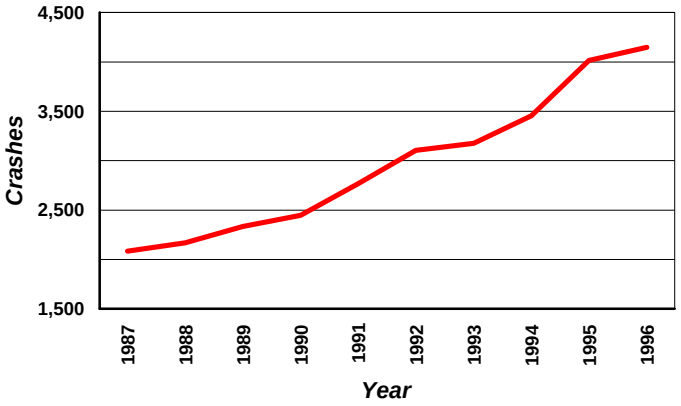


"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

Net Change ('87-'96)= -464 or -4.9%
High= 11,113
Low= 7,357
Average= 8,924
Rate of Change=
-214 crashes per year

Run Off the Road crashes are essentially at the same level as ten years ago (-5%) after having dropped significantly from 1988 to 1994.

Animal Crashes

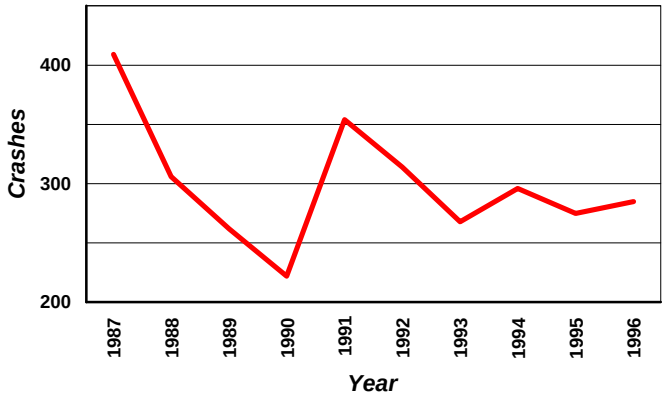


"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

Net Change ('87-'96)= +2,062 or +99%
High= 4,148
Low= 2,086
Average= 2,970
Rate of Change= +240 crashes per year

Animal crashes have shown a steady and continuous increase over the past decade, having nearly doubled in this time frame.

Bicycle Crashes

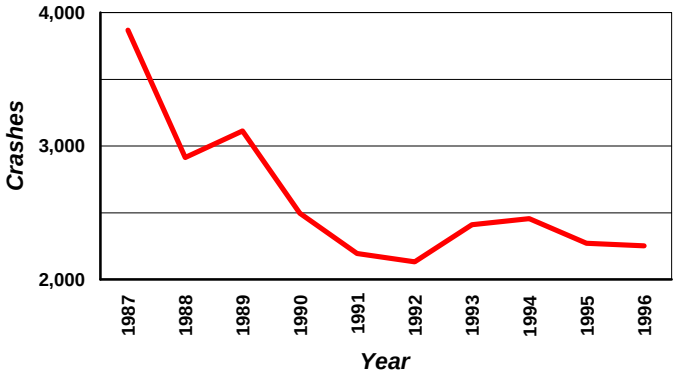


"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

Net Change ('87-'96)= -124 or -30%
High= 409
Low= 222
Average= 299
Rate of Change= -6.5 crashes per year

Bicycle crashes have dropped about 30% over the past ten years, though the reduction from 1987 to 1990 was twice that value.

Commercial Vehicle Crashes (All Types)



"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

Net Change ('87-'96)= -1,616 or -42%
High= 3,869
Low= 2,132
Average= 2,612
Rate of Change= -137 crashes per year

Commercial Vehicle crashes have dropped 42% in the past decade. The crash report form changed dramatically in 1996.

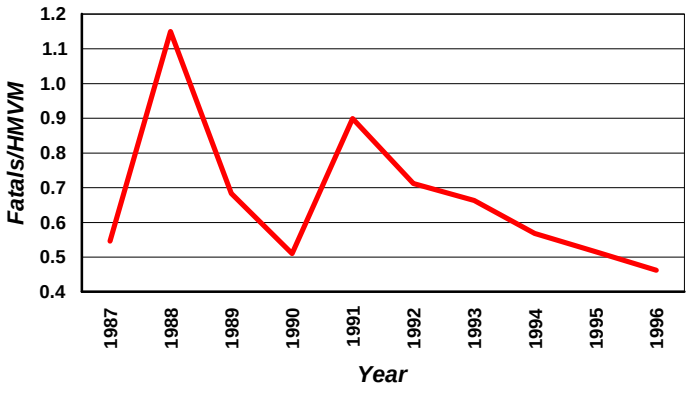
Trends for Fatal Crash Rates by Road Classification

From 1987 through 1996, fatal crash rates have dropped on all road classes. The drop was most significant for Minor Arterials and Minor Collectors (fatal crash rate down 64% and 55%, respectively). In addition, Principal Arterials and Major Collectors each experienced a decrease of 32%. The Interstate, which has the lowest fatal crash rate, dropped 15%, while Local Roads, which have the highest fatal crash rate, experienced a decrease of 13%. The fatal crash rates and the change in fatal crash rate over the ten year period are summarized in the following table. Note that changes in road classifications have occurred, primarily between Principal Arterials and Minor Arterials, and between Major Collectors and Minor Collectors, especially in 1992 and 1993.

Road Classification	1996 Fatal Crash Rate Crashes per HMVM	Ten Year Change
Interstate	0.46	-15%
Principal Arterials	1.29	-32%
Minor Arterials	0.82	-64%
Major Collectors	1.37	-32%
Minor Collectors	1.45	-55%
Local Roads	2.49	-13%

The following charts show ten-year trends for specific highway classifications. The following information is given for each graph: Net Change (1987-1996), Ten Year High, Ten Year Low, Ten Year Average, Ten Year Rate of Change. System wide, fatal crash rates have dropped 38%, with a ten-year high of 2.04 crashes/HMVM and a ten-year low of 1.21 crashes/HMVM. The ten-year average was 1.55 fatal crashes/HMVM.

Interstate Highways

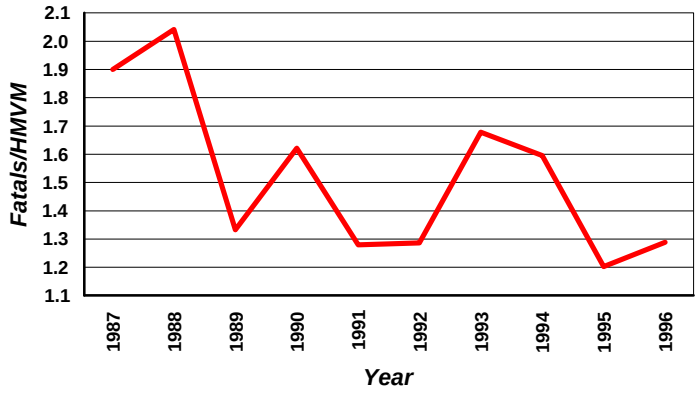


Net Change ('87-'96)= -0.08 or -15%
High= 1.15
Low= 0.46
Average= 0.67
Rate of Change=
-0.03 fatal crashes/HMVM

The interstate exhibits the lowest fatal crash rate of all road classes in Maine.

"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996
Inventory Section, MDOT, 1997

Principal Arterials

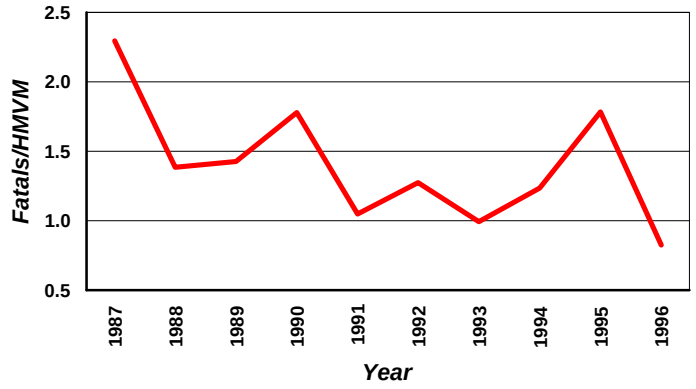


"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996
Inventory Section, MDOT, 1997

Net Change ('87-'96)= -0.61 or -32%
High= 2.04
Low= 1.20
Average= 1.52
Rate of Change=
-0.06 fatal crashes/HMVM

Principal Arterials have shown a 32% reduction in the fatal crash rate over the past ten years.

Minor Arterials

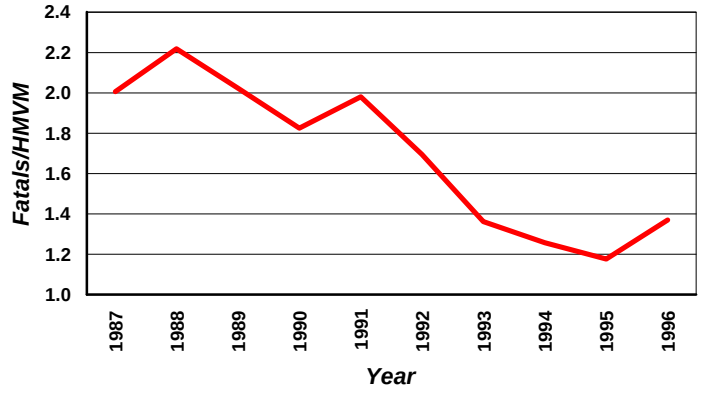


"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996
Inventory Section, MDOT, 1997

Net Change ('87-'96)= -1.47 or -64%
High= 2.30
Low= 0.825
Average= 1.41
Rate of Change=
-0.08 fatal crashes/HMVM

Minor Arterials have shown a 64% reduction in the fatal crash rate over the past ten years, but have also exhibited dramatic increases in the interim period.

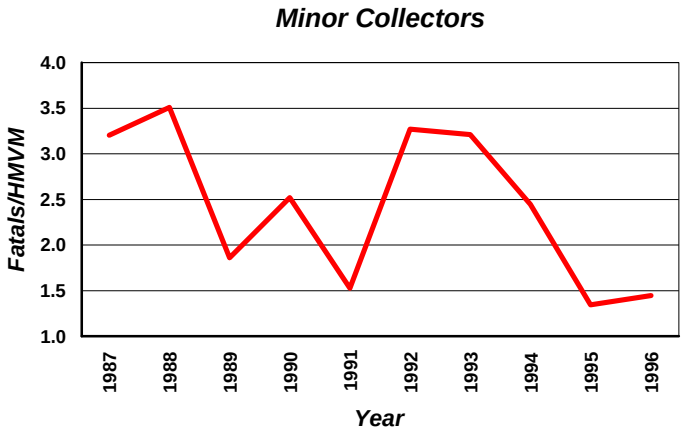
Major Collectors



"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996
Inventory Section, MDOT, 1997

Net Change ('87-'96)= -0.63 or -31%
High= 2.22
Low= 1.18
Average= 1.69
Rate of Change=
-0.11 fatal crashes/HMVM

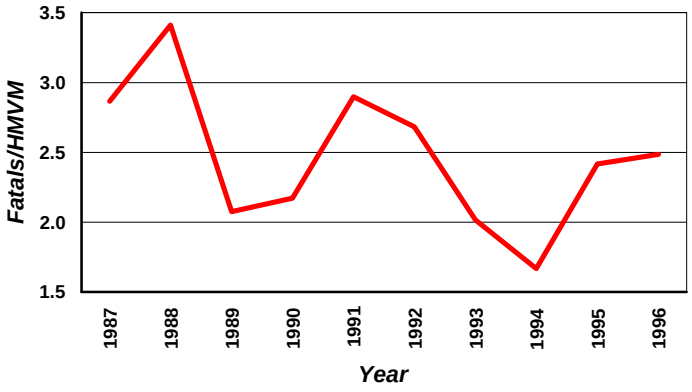
Major Collectors have shown a 32% reduction in the fatal crash rate over the past ten years, but the rate may be increasing now.



"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996

Net Change ('87-'96)= -1.76 or -55%
High= 3.51
Low= 1.34
Average= 2.44
Rate of Change=
-0.15 fatal crashes/HMVM

The fatal crash rate on Minor Collectors has dropped nearly 55% in the past ten years, but doubled in one year (1991-1992).



"State of Maine Accident & Highway Facts", MDOT, 1995
"Maine Highway Crash Facts", MDOT, 1995 & 1996
Inventory Section, MDOT, 1997

Net Change ('87-'96)= -0.38 or -13%
High= 3.41
Low= 1.67
Average= 2.47
Rate of Change=
-0.08 fatal crashes/HMVM

The fatal crash rate on Local Roads appears to be cyclical, but shows an overall reduction of 13% over the ten year period. The rate is five times greater than on the interstate.

Summary and Conclusions

Based upon a review of the crash data and analysis of crash trends from 1987 through 1996, several observations can be made. In general, the past decade has seen a marked reduction in the fatal crash rate (down 38%) and the overall crash rate (down 22%). It can be assumed that at least part of this reduction is due to a combination of increased automobile safety equipment (primarily the introduction of driver and passenger air bags), an increased usage of seat belts, and the 1989-1992 economic downturn. The recent improvement in the economy appears to be reversing this earlier trend, however, as most crash rates are again on the increase.

The overall crash rate has been reduced 22% over the past decade, and the fatal crash rate has dropped 38%.

Hazard Elimination Program project locations for the 1987-1993 period have exhibited a crash cost reduction of 31% from the three years prior to construction to the three year post-construction period.

HEP projects have resulted in a 31% reduction in crash costs.

With a few exceptions, nearly all crash classification types have seen a roughly 30% reduction over the past ten years. The exceptions, in descending order, are as follows:

- Object in Road: +560%;
- Animal: +99%;
- Rear End: +9%; and
- Run Off Road: -9%.

While the most common type of crash in Maine is Rear End, it ranks a distant fifth in the number of resulting fatalities when compared to other crash types, as listed below in descending order:

- Run Off Road (89,241 crashes, 650 fatalities);
- Head On (23,568 crashes, 479 fatalities);
- Pedestrian (3,751 crashes, 190 fatalities);
- Intersection Movement (90,284 crashes, 149 fatalities); and
- Rear End (116,605 crashes, 91 fatalities).

Fatal crash rates have exhibited the largest relatively consistent decline on Major Collectors (down 32%).

Work zone crashes have decreased from a high of 1,044 crashes in 1987 to 663 crashes in 1996, an overall decrease of 36%. The percentage reductions by work zone type are listed below:

- Utility: -47%;
- Maintenance: -24%; and
- construction: -38%.

These findings indicate that the Hazard Elimination Program is highly effective in reducing the number and severity of crashes in Maine. Additional attention may need to be focused to address Run Off the Road, Head On, Pedestrian, and Intersection Movement crashes, as they tend to generate the greatest number of fatalities.

Additional analyses will be performed to ensure that the overall severity of these types of crashes mirrors the preliminary conclusions based on the fatality rates for these crashes. More detailed analyses will be made as relational data bases and access to them become available over the coming months.